

Fermi National Accelerator Laboratory LDRD Project Data Sheet - FY15

Project ID: FNAL-LDRD-2015-021

Project title: Transverse and Longitudinal Profile Diagnostics for H- Beams using Fiber Lasers and Synchronous Detection

Principal investigator: Victor Scarpine

Project description: (short description and explanation of cutting edge, high-risk, high-potential science or engineering)

The proposal is to test the concept of a combined transverse and longitudinal H- beam profiling instrument utilizing a low-power, high rep-rate fiber laser with optical fiber transport to the accelerator and synchronous signal detection. The expected small photo-disassociation signal will be detected through a narrow-band synchronous detection of a modulated laser pulse train. In addition, we propose to test the concept of acquiring these beam profiles by measuring the reduction in H- beam current.

Tie to Mission: (explain the project's relevance or anticipated benefits to Fermilab's and DOE's missions)

Beam diagnostics often lead to improvements in accelerator performance. The proposal is a novel approach for making non-invasive measurements of the beam profile for an H- beam relevant for the PIP-I, PXIE, PIP-II, and IOTA accelerator projects or proposed projects at Fermilab and elsewhere in the DOE complex where H- beams are used. The approach has advantages over conventional techniques with regards to safety, reduced beamline space, and increased measurement sensitivity.

Previous year's accomplishments: (as applicable)

The laser design is nearly complete with some technology issues causing some delay. The purchase of the fiber laser amplifier is nearly final being specified and discussed with possible vendors. The seed laser is being testing without the amplifier. Vacuum design and procurement of vacuum hardware is underway. Some electronics has been purchased.

Work proposed for current fiscal year and anticipated / desired results:

The work to finish the design and begin installation at PXIE will continue into FY16. This includes the vacuum hardware, the electron collection system, the seed laser system, and optics. Software will be developed in parallel with a goal to have initial beam profile measurements by the end of FY. This allows work to continue in FY17 towards demonstrating and measuring the characteristics of the new beam profiling instrument.

Project funding profile: (costs, budgets, projected budgets, and total)

Prior year(s) costs	FY15 through 8/15	FY16 budgeted	FY17 budgeted	Total
N/A	28884	170000	210000	408,884

Project Start Data: 2/1/2015 (est) Total Approved Project funds: \$ 464,700